Environ Health Perspect
DOI: 10.1289/ehp.1409546

Supplemental Material

Elemental Constituents of Particulate Matter and Newborn's Size in Eight European Cohorts

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Figure S1. Distributions of $PM_{2.5}$, PM_{10}, maternal height, pre-pregnancy weight, birth weight, birth head circumference and gestational age by cohorts and for the pooled study population. The line in the middle of the box represents the median values, the ends of the box refer to the 25th and 75th percentiles and the ends of the whiskers indicate the variability outside the upper and lower quartiles (i.e., within 1.5 interquartile range of the lower quartile and upper quartile). Outliers are plotted as individual dots.

Table S1. Mother-child cohort data collection.

Cohort	Country	Centre(s)	Inclusion and exclusion criteria N (n)	Methods of maternal information collection	Gestational age estimation	Pregnancy (Years)	Air sampling (Pollutants) (Years)
BAMSE 'Barn, Allergi, Miljo, Stockholm, Epidemiologi' 'Child, Allergy, Environment, Stockholm, Epidemiology'	Sweden	Jarfalla Solna Sundbyberg Stockholm	All parents of newborn children during 1994-1996 living in the study area, with no plans of moving within 1 year after birth, sufficient Swedish language skills and no serious family diseases. Included only women with one child. N=4,089. Pregnancy exposure to air pollution is available (n=3,868).	Self-administrated questionnaires starting at 3 months after birth of the child.	US based estimation (89%)	1994-1996	$PM + NO_X$ 2008-2009
DNBC 'Bedre Sundhed for Mor og Barn Undersøgelsen' 'Danish National Birth Cohort'	Denmark	National	All pregnant women who attended general practitioner in week 6-12 of pregnancy, who wanted to carry their pregnancy to term, and had sufficient Danish language skills to complete interviews during 1996-2002. Same women may participate multiple times. N=101,042. Pregnancy exposure to air pollution is available for the greater Copenhagen (n=17,577).	Computerized telephone interviews starting in week 12 of pregnancy.	LMP and US based estimation available.	1996-2002	$PM + NO_X$ 2009-2010
KANC	Lithuania	Kaunas	All pregnant women who attended general practitioner in first trimester of pregnancy during 2007-2008. Women who lived outside Kaunas municipality, had medical records of pregnancy induced hypertension and/or diabetes were excluded. Pregnancy exposure to air pollution is available (n=4,101).	Face-to-face interviews by trained nurse and telephone interviews during pregnancy.	Maternity unit based estimation in which LMP is combined with US.	2007-2008	$PM + NO_X$ 2010-2011
ABCD 'Amsterdam Born Children and Their Development'	The Netherlands	Amsterdam	All pregnant women who lived in Amsterdam and attended prenatal care in early pregnancy during 2003-2004. Excluded multiple, stillbirth. N=7,863. Pregnancy exposure to air pollution is available (n=7,592).	Self-administrated questionnaires starting in early pregnancy.	Maternity unit based estimation relying on US or LMP if US was unavailable (<10%).	2003-2004	$PM + NO_X$ 2009-2010
PIAMA 'Prevention and Incidence of Asthma and Mite Allergy'	The Netherlands	North West Middle	Pregnant women who attended prenatal healthcare in approximately 50 clinics located in different parts of the Netherlands. Atopic (n=1327) and non-atopic women (n=2,819) were included. Pregnancy exposure to air pollution is available (n=3,839).	Self-administrated questionnaires starting at the women's first visit to the prenatal health clinics, which usually takes place during the first trimester.	Maternity unit based estimation in which LMP is combined with US.	1996-1997	$PM + NO_X$ 2009-2010

Table S1. Mother-child cohort data collection – cont.

Cohort	Country	Centre(s)	Inclusion and exclusion criteria N (n)	Methods of maternal information collection	Gestational age estimation	Pregnancy (Years)	Air sampling (Pollutants) (Years)
DUIBURG	Germany	Duisburg	Pregnant women who lived in a predefined area of Duisburg. Healthy, German or Turkish speaking women without serious pregnancy and/or birth complications with birth at term (i.e. ≥38-42 weeks of gestation) to children without APGAR scores ≥8 and without congenital anomalies. N=232. Pregnancy exposure to air pollution is available (n=194).	Face-to-face interviews starting in early pregnancy.	Maternity unit based estimation in which LMP is combined with US.	2000-2002	PM + NO_X 2008-2009
GASPII	Italy	Rome	Women delivering at two hospitals in the area of the local health unit RME in the north of the city, resident in the same area, Italian speaking, aged more than 17 years. Out of the all women contacted, 55% responded, out the eligible women contacted 34% responded. Pregnancy exposure to air pollution is available (n=684).	Face-to-face the day after delivery.	LMP based estimation and maternity unit.	2003-2004	PM + NO_X 2010-2011
INMA 'INfancia y Medio Ambiente' 'Childhood and Environment'	Spain	Sabadell	Pregnant women who attended prenatal care 10-13 week of pregnancy. Included women had delivery and residence in the study areas, at least 16 years old, singleton pregnancies, no assisted reproduction and no communication problems. Enrolment took place in Sabadell (n=657, 2004-2006).	Face-to-face interviews and self-administrated questionnaires starting early pregnancy.	LMP, US and maternity unit based estimation in which LMP is combined with US. US was used when the difference with the LMP and US estimation was ≥ 7 days (12% of the cases).	2004-2006	PM + NO_X 2009-2010

N refers to total number of participation women at birth; n refers to the number of participation women living in the ESCAPE LUR exposure areas with sufficient data to estimate the exposures during pregnancy; NO_X refers to nitrogen oxides; LMP refers to last menstrual period; PM refers to particulate matter and US refers to ultrasound.

Table S2. Variance of between- vs. within-center variations for the elements.

	Between-center variance	Within-center variance	Between/within-center variances ratio
$PM_{2.5}$	37.1	2.8	13.2
Cu	7.7	1.7	4.4
Fe	2888.5	2142.2	1.3
K	2819.7	93.4	30.2
Ni	0.5	0.06	8.3
S	4507.8	713.4	63.4
Si	3268.8	472.8	6.9
V	1.4	0.3	5.7
Z	63.2	7.4	8.6
PM_{10}	76.9	11.2	6.9
Cu	105.5	67.5	1.6
Fe	59156.9	30967.9	1.9
K	8215.9	1392.8	5.9
Ni	1.1	0.2	7.5
S	59338.7	1888.6	31.4
Si	114440.1	28941.9	4.0
V	2.0	0.4	4.9
Z	146.7	49.6	3.0

Table S3. Correlations between PM constituents (ng/m^3).

$PM_{2.5}$	Cu	Fe	K	Ni	S	Si	V	Cu	Fe	K	Ni	S	Si	V	Zn
Cu								0.82	0.78	0.60	0.53	0.48	0.46	0.40	0.59
Fe	0.77							0.76	0.76	0.55	0.42	0.19	0.56	0.28	0.52
K	0.61	0.33						0.43	0.33	0.63	0.04	0.21	0.23	0.04	0.30
Ni	0.48	0.39	-0.06					0.49	0.67	0.28	0.97	0.88	0.68	0.84	0.57
S	0.50	0.20	0.26	0.82				0.38	0.36	0.02	0.69	0.95	-0.10	0.65	0.61
Si	0.53	0.58	0.34	0.55	-0.07			0.47	0.68	0.86	0.36	-0.06	0.92	0.04	0.37
V	0.35	0.18	-0.001	0.91	0.74	-0.08		0.39	0.38	-0.07	0.80	0.84	0.006	0.95	0.32
Zn	0.44	0.24	0.33	0.36	0.66	0.17	0.27	0.34	0.39	0.25	0.45	0.60	0.12	0.23	0.80
PM_{10}															
Cu															
Fe								0.85							
K								0.52	0.69						
Ni								0.54	0.68	0.28					
S								0.41	0.38	-0.001	0.75				
Si								0.44	0.72	0.84	0.41	-0.07			
V								0.44	0.46	0.07	0.80	0.77	0.14		
Zn								0.52	0.65	0.41	0.53	0.60	0.38	0.35	

Pearson Correlations had a p-value >0.001, all others p-values were<0.001.

Table S4. Correlations between elemental (ng/m^3) and total mass concentration of PM (μg/m^3) by cohort.

	BAMSE		DNBC		ABCD		PIAMA		KANC		DUISBURG		GASPII		INMA	
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}
Cu	0.60	0.28	0.58	0.72	0.34	0.29	0.60	0.44	0.41	0.42	0.44	0.56	0.78	0.83	0.61	0.53
Fe	0.56	0.69	0.55	0.73	0.21	0.48	0.53	0.59	na	0.67	0.44	0.79	0.81	0.86	0.48	0.62
K	0.35	0.92	0.09	0.18	0.13	0.41	0.34	0.50	na	na	na	0.33	0.62	0.67	0.43	0.75
Ni	na	0.09	0.62	0.76	0.02[a]	0.30	0.43	0.46	na	0.42	0.65	0.78	0.20	0.28	0.40	0.50
S	0.45	0.44	0.62	0.73	0.08	0.19	0.55	0.40	na	na	0.47	0.63	0.69	0.30	0.44	0.44
Si	0.42	0.92	0.66	0.77	0.14	0.46	0.51	0.63	0.05[a]	0.11	0.70	0.65	0.56	0.54	0.69	0.76
V	0.32	0.68	0.60	0.71	0.02[a]	0.15	0.41	0.40	-0.02[a]	-0.03[a]	0.39	0.39	0.34	0.70	0.35	0.38
Zn	0.44	0.60	0.57	0.73	0.13	0.38	0.29	0.30	na	0.26	0.60	0.59	0.70	0.85	0.44	0.22

Na refers to not available.

[a]Pearson Correlations had a p-value >0.001, all others p-values were<0.001.

Particle mass concentrations are pregnancy averages and particle constituents are annual averages.

Table S5. Sensitivity and stratified analyses of sulfur on term LBW.

	S $PM_{2.5}$					S PM_{10}				
Model	N [a]	n [b]	OR	(95%CIs)	p [c]	N	n	OR	(95%CIs)	p [c]
Women who did not change address [d]	25,765	300	1.35	(1.14, 1.60)		25,765	300	1.28	(1.12, 1.45)	
Study areas with highest LUR-model prediction [e]	17,006	192	1.18	(0.90, 1.55)		27,339	351	1.17	(1.01, 1.36)	
Excluding DNBC	14,949	223	1.36	(1.11, 1.68)		14,949	233	1.30	(1.10, 1.53)	
Women who participated once	29,878	379	1.35	(1.16, 1.57)		29,878	379	1.27	(1.13, 1.43)	
Women with information on maternal ethnic origin	29,904	379	1.32	(1.14, 1.55)		29,904	377	1.25	(1.11, 1.41)	
Additional adjustment for maternal ethnic origin	29,904	377	1.30	(1.11, 1.53)		29,904	377	1.23	(1.09, 1.40)	
Stratified on country of birth										
Women born in country of cohort	26,714	309	1.27	(1.07, 1.51)		26,714	309	1.24	(1.02, 1.50)	
Women born elsewhere	3,190	68	1.60	(0.96, 2.64)	0.28	3,190	68	1.45	(0.99, 2.11)	0.23
Stratified on education										
Women with low education	6,029	119	1.25	(0.92, 1.70)		6,029	119	1.18	(0.93, 1.49)	
Women with middle education	14,017	158	1.48	(1.18, 1.86)	0.67	14,017	158	1.50	(1.12, 2.01)	0.40
Women with high education	10,530	104	1.25	(0.95, 1.65)	0.94	10,530	104	1.12	(0.90, 1.38)	0.60
Women with information on second-hand smoke exposure	27,245	377	1.18	(0.97, 1.45)		27,245	346	1.15	(0.99, 1.33)	
Additional adjustment for second-hand smoke exposure	27,245	346	1.18	(0.96, 1.45)		27,245	346	1.14	(0.98, 1.33)	
Stratified on maternal smoking										
Non-smoking women	26,061	265	1.27	(1.07, 1.51)		26,061	265	1.21	(1.06, 1.39)	
Smoking women	4,515	116	1.47	(1.09, 1.98)	0.49	4,515	116	1.36	(1.08, 1.71)	0.47
Stratified on sex										
Women giving birth to a boy	15,500	148	1.35	(1.06, 1.72)		15,500	148	1.27	(1.05, 1.53)	
Women giving birth to a girl	15,076	233	1.36	(1.12, 1.65)	0.86	15,076	233	1.28	(1.10, 1.48)	0.88
Stratified on parity										
Primiparous women	14,694	116	1.64	(1.24, 2.17)		14,694	116	1.44	(1.16, 179)	
Mulitiparous women	15,882	265	1.26	(1.05, 1.50)	0.17	15,882	265	1.21	(1.05, 1.39)	0.27
Stratified on age										
Women aged <25 years at time of giving birth	3,180	59	1.27	(0.82, 1.96)		3,180	59	1.07	(0.78, 1.47)	
Women aged 25-35 years at time of giving birth	22,325	250	1.30	(1.08, 1.57)	0.13	22,325	250	1.23	(1.07, 1.43)	0.90
Women aged >35 years at time of giving birth	5,071	72	1.45	(1.03, 2.03)	0.81	5,071	72	1.44	(1.10, 1.88)	0.58
Stratified on season of conception										
Conception in January-March	6,622	87	1.36	(1.01, 1.84)		6,622	87	1.39	(1.09, 1.77)	
Conception in April-June	6,360	76	1.13	(0.80, 1.58)	0.59	6,360	76	1.03	(0.79, 1.34)	0.14
Conception in July-September	8,271	97	1.63	(1.19, 2.23)	0.53	8,271	97	1.41	(1.12, 1.79)	0.89
Conception in October-December	9,323	121	1.35	(1.03, 1.77)	0.93	9,323	121	1.28	(1.04, 1.57)	0.51

Effect estimates refer to odds ratio (OR) and 95% confidence interval (CIs) for LBW (<2,500 g) among term births (≥37 weeks of gestation) from pooled analyses using logistic regression models with random effect of centre. See table 3 for increments and adjustment. [a]N refers number of subjects in each model. [b]n refers number of cases in each model. [c]P from interaction term. [d]During pregnancy. [e]Excluding BAMSE, ABCD and PIAMA for S $PM_{2.5}$ and BAMSE for S PM_{10}.

Table S6. Sex-stratified associations between exposure to PM constituents and term LBW.

Sex	$PM_{2.5}$				PM_{10}			
Mass	N[a]	n[b]	OR[c]	(95%CIs)	N[a]	n[b]	OR[c]	(95%CIs)
Boys	15,354	149	1.30	(1.09, 1.55)	15,354	149	1.37	(1.12, 1.69)
Girls	14,959	232	1.18	(0.96, 1.44)	14,959	236	1.11	(0.88, 1.41)
Cu								
Boys	15,805	154	1.22	(0.86, 1.73)	15,805	154	1.26	(0.98, 1.62)
Girls	15,368	236	0.97	(0.65, 1.43)	15,368	233	1.02	(0.77, 1.37)
Fe								
Boys	15,500	148	1.29	(0.92, 1.82)	15,805	154	1.26	(0.96, 1.66)
Girls	15,076	233	0.98	(0.75, 1.28)	15,076	236	0.88	(0.61, 1.25)
K								
Boys	15,409	147	1.06	(0.83, 1.35)	15,500	148	0.96	(0.76, 1.21)
Girls	14,973	228	1.00	(0.74, 1.35)	15,973	233	0.82	(0.62, 1.09)
Ni								
Boys	13,847	136	1.11	(0.90, 1.36)	15,805	154	1.17	(0.89, 1.54)
Girls	13,492	215	1.16	(0.99, 1.36)	15,368	236	1.50	(1.07, 2.11)
S								
Boys	15,500	148	1.35	(1.06, 1.72)	15,500	148	1.27	(1.05, 1.53)
Girls	15,076	233	1.36	(1.12, 1.65)	15,076	233	1.28	(1.10, 1.48)
Si								
Boys	15,805	154	0.88	(0.62, 1.25)	15,805	154	0.94	(0.71, 1.24)
Girls	15,368	236	0.75	(0.49, 1.13)	15,368	236	0.81	(0.59, 1.10)
V								
Boys	15,805	154	1.18	(0.92, 1.50)	15,805	154	1.20	(0.88, 1.65)
Girls	15,368	233	1.20	(0.89, 1.64)	15,368	236	1.03	(0.68, 1.55)
Zn								
Boys	15,500	148	1.21	(0.90, 1.62)	15,805	154	1.46	(1.12, 1.90)
Girls	15,076	232	1.26	(0.96, 1.66)	15,368	236	1.06	(0.78, 1.43)

[a]N refers to the number of subjects in each model. [b]n refers to the number of term LBW cases in each model. [c]Odds ratio (OR) and 95% confidence interval (CIs) for LBW (<2,500 g) among term births (≥37 weeks of gestation) from pooled analyses using logistic regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception per increments of 5 $\mu g/m^3$ for $PM_{2.5}$; 5 ng/m_3 for Cu $PM_{2.5}$; 100 ng/m^3 for Fe $PM_{2.5}$; 50 ng/m^3 for K $PM_{2.5}$; 1 ng/m^3 for Ni $PM_{2.5}$; 200 ng/m^3 for S $PM_{2.5}$; 100 ng/m^3 for Si $PM_{2.5}$; 2 ng/m^3 for V $PM_{2.5}$; 10 ng/m^3 for Zn $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 5 ng/m_3 for Cu $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 20 ng/m^3 for Cu PM_{10}; 500 ng/m^3 for Fe PM_{10}; 100 ng/m^3 for K PM_{10}; 2 ng/m^3 for Ni PM_{10}; 200 ng/m^3 for S PM_{10}; 500 ng/m^3 for Si PM_{10}; 3 ng/m^3 for V PM_{10}; and 20 ng/m^3 for Zn PM_{10}.

Table S7. Associations between exposure to PM constituents and term LBW results from the study population with information on atmospheric pressure and pressure adjusted models.

	Without adjustment for atmospheric pressure[a]								With adjustment for atmospheric pressure[b]							
	$PM_{2.5}$				PM_{10}				$PM_{2.5}$				PM_{10}			
Exposure	N	n	OR	(95%CIs)	N	n	OR	(95%CIs)	N	OR	(95%CIs)		N	OR	(95%CIs)	
Mass	29,716	372	1.23	(1.05, 1.43)	29,716	372	1.23	(1.02, 1.48)	29,716	1.25	(1.03, 1.52)		29,716	1.24	(0.98, 1.56)	
Cu	30,576	381	1.08	(0.08, 1.45)	30,576	381	1.13	(0.92, 1.40)	30,576	1.17	(0.89, 1.55)		30,576	1.18	(0.96, 1.46)	
Fe	30,576	381	1.14	(0.92, 1.41)	30,576	381	1.07	(0.83, 1.37)	30,576	1.17	(0.95, 1.44)		30,576	1.06	(0.83, 1.37)	
K	30,382	375	1.05	(0.82, 1.33)	30,576	381	0.90	(0.73, 1.11)	30,382	1.21	(0.98, 1.50)		30,576	0.92	(0.77, 1.11)	
Ni	27,339	351	1.14	(1.00, 1.29)	30,576	381	1.33	(0.96, 1.85)	27,339	0.94	(0.74, 1.20)		30,576	1.07	(0.79, 1.46)	
S	30,576	381	1.36	(1.17, 1.58)	30,576	381	1.27	(1.13, 1.43)	30,576	1.28	(1.05, 1.57)		30,576	1.28	(1.08, 1.52)	
Si	30,576	381	0.82	(0.60, 1.12)	30,576	381	0.90	(0.71, 1.14)	30,576	0.78	(0.60, 1.02)		30,576	0.87	(0.72, 1.06)	
V	30,576	381	1.11	(0.84, 1.46)	30,576	381	0.98	(0.69, 1.38)	30,576	1.10	(0.87, 1.37)		30,576	1.06	(0.79, 1.43)	
Zn	30,576	381	1.23	(0.98, 1.54)	30,576	381	1.25	(0.98, 1.59)	30,576	1.14	(0.91, 1.41)		30,576	1.18	(0.94, 1.49)	

[a]Pooled analyses using regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception restricted to subjects with information on atmospheric pressure (i.e. KANC is excluded). [b]Further adjusted for atmospheric pressure during full pregnancy (mBar coded as restricted cubic spline).

Table S8. Associations between exposure to PM constituents and term LBW results from between centers and within centers models.

	$PM_{2.5}$					PM_{10}				
	N[a]	n[b]	OR[c]	(95%CI)	p[d]	N[a]	n[b]	OR[c]	(95%CI)	p[d]
Particle mass										
Overall[e]	30,313	381	1.21	(1.08, 1.36)	0.94	30,313	381	1.22	(1.03, 1.45)	0.56
Between centers[f]	30,313	381	1.21	(1.08, 1.37)		30,313	381	1.20	(1.01, 1.58)	
Within centers[g]	30,313	381	1.20	(0.89, 1.63)		30,313	381	1.40	(0.84, 1.54)	
Cu										
Overall[e]	31,173	390	1.08	(0.81, 1.44)	0.65	31,173	390	1.13	(0.92, 1.39)	0.81
Between centers[f]	31,173	390	1.17	(0.76, 1.79)		31,173	390	1.19	(0.75, 1.88)	
Within centers[g]	31,173	390	1.02	(0.69, 1.50)		31,173	390	1.12	(0.88, 1.41)	
Fe										
Overall[e]	30,576	381	1.14	(0.92, 1.41)	0.37	31,173	390	1.06	(0.83, 1.36)	0.80
Between centers[f]	30,576	381	0.92	(0.56, 1.52)		31,173	390	1.12	(0.70, 1.81)	
Within centers[g]	30,576	381	1.18	(0.95, 1.48)		31,173	390	1.05	(0.79, 1.39)	
K										
Overall[e]	30,382	375	1.05	(0.82, 1.33)	0.67	30,576	381	0.90	(0.73, 1.11)	0.92
Between centers[f]	30,382	375	1.02	(0.78, 1.33)		30,576	381	0.89	(0.68, 1.18)	
Within centers[g]	30,382	375	1.16	(0.69, 1.95)		30,576	381	0.91	(0.68, 1.22)	
Ni										
Overall[e]	27,339	351	1.14	(1.00, 1.29)	0.61	31,173	390	1.29	(0.96, 1.75)	0.66
Between centers[f]	27,339	351	1.15	(1.01, 1.32)		31,173	390	1.36	(0.93, 2.00)	
Within centers[g]	27,339	351	1.03	(0.70, 1.53)		31,173	390	1.19	(0.74, 1.92)	
S										
Overall[e]	30,576	381	1.36	(1.17, 1.58)	0.24	30,576	381	1.27	(1.13, 1.43)	0.72
Between centers[f]	30,576	381	1.38	(1.19, 1.61)		30,576	381	1.28	(1.14, 1.44)	
Within centers[g]	30,576	381	0.87	(0.41, 1.86)		30,576	381	1.18	(0.75, 1.85)	
Si										
Overall[e]	31,173	390	0.83	(0.62, 1.12)	0.50	31,173	390	0.89	(0.71, 1.13)	0.19
Between centers[f]	31,173	390	0.77	(0.53, 1.11)		31,173	390	0.77	(0.56, 1.05)	
Within centers[g]	31,173	390	0.95	(0.58, 1.55)		31,173	390	1.04	(0.76, 1.43)	
V										
Overall[e]	31,173	390	1.12	(0.86, 1.44)	0.48	31,173	390	1.00	(0.72, 1.38)	0.94
Between centers[f]	31,173	390	1.22	(0.87, 1.70)		31,173	390	0.98	(0.61, 1.58)	
Within centers[g]	31,173	390	1.02	(0.71, 1.46)		31,173	390	1.01	(0.64, 1.58)	
Zn										
Overall[e]	30,576	381	1.23	(0.98, 1.54)	0.18	31,173	390	1.23	(0.98, 1.53)	0.29
Between centers[f]	30,576	381	1.43	(1.05, 1.95)		31,173	390	1.45	(1.00, 2.10)	
Within centers[g]	30,576	381	1.05	(0.76, 1.45)		31,173	390	1.13	(0.86, 1.47)	

[a]N refers to the number of subjects in each model. [b]n refers to the number of term low birth weight cases in each model. [c]Odds ratio (OR) and 95% confidence interval (CI) for low birth weight (<2,500 g) among term births (≥37 weeks of gestation) from pooled analyses using logistic regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception per increments of 5 $\mu g/m^3$ for $PM_{2.5}$; 5 ng/m_3 for Cu $PM_{2.5}$; 100 ng/m^3 for Fe $PM_{2.5}$; 50 ng/m^3 for K $PM_{2.5}$; 1 ng/m^3 for Ni $PM_{2.5}$; 200 ng/m^3 for S $PM_{2.5}$; 100 ng/m^3 for Si $PM_{2.5}$; 2 ng/m^3 for V $PM_{2.5}$; 10 ng/m^3 for Zn $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 5 ng/m_3 for Cu $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 20 ng/m^3 for Cu PM_{10}; 500 ng/m^3 for Fe PM_{10}; 100 ng/m^3 for K PM_{10}; 2 ng/m^3 for Ni PM_{10}; 200 ng/m^3 for S PM_{10}; 500 ng/m^3 for Si PM_{10}; 3 ng/m^3 for V PM_{10}; and 20 ng/m^3 for Zn PM_{10}. [d]P-value from a test comparing the effect estimate of between center and within center. [e]Results correspond to the individual exposure estimates as reported in the main text and tables. [f]Results correspond to the centerwide mean. [g]Results correspond to the difference between individual exposure and centerwide mean exposure.

Table S9. Associations between exposure to PM constituents and birth weight results from the study population with information on atmospheric pressure and pressure adjusted models.

	Without adjustment for atmospheric pressure[a]						With adjustment for atmospheric pressure[b]					
	$PM_{2.5}$			PM_{10}			$PM_{2.5}$			PM_{10}		
Exposure	N	β	(95%CIs)	N	β	(95%CIs)	N	β	(95%CIs)	N	β	(95%CIs)
Mass	29,716	-13	(-27, 1)	29,716	-10	(-24, 5)	29,716	-18	(-32, -5)	29,716	-9	(-24, 5)
Cu	30,576	11	(-7, 28)	30,576	8	(-3, 19)	30,576	7	(-10, 24)	30,576	7	(-4, 18)
Fe	30,576	6	(-5, 16)	30,576	15	(2, 28)	30,576	5	(-5, 15)	30,576	15	(1, 28)
K	30,382	11	(-11, 33)	30,576	14	(2, 27)	30,382	-2	(-21, 16)	30,576	13	(1, 25)
Ni	27,339	4	(-15, 22)	30,576	2	(-22, 25)	27,339	-6	(-18, 6)	30,576	0.5	(-22, 23)
S	30,576	-40	(-64, -16)	30,576	-2	(-21, 17)	30,576	-47	(-61, -34)	30,576	-29	(-41, -17)
Si	30,576	28	(7, 49)	30,576	14	(-1, 27)	30,576	30	(9, 50)	30,576	16	(3, 30)
V	30,576	6	(-13, 24)	30,576	15	(-6, 37)	30,576	1	(-17, 18)	30,576	9	(-12, 30)
Zn	30,576	-4	(-21, 12)	30,576	9	(-4, 22)	30,576	-8	(-23, 8)	30,576	8	(-5, 21)

[a]Pooled analyses using regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception restricted to subjects with information on atmospheric pressure among term births (i.e. KANC is excluded). [b]Further adjusted for atmospheric pressure during full pregnancy (mBar coded as restricted cubic spline).

Table S10. Associations between exposure to PM constituents and birth weight results from between centers and within centers models.

	$PM_{2.5}$				PM_{10}			
	N[a]	ß[b]	(95%CI)	p[c]	N[a]	ß[b]	(95%CI)	p[c]
Mass								
Overall[d]	30,313	-16	(-29, -3)	0.02	30,313	-11	(-25, 2)	<0.01
Between centers[e]	30,313	-48	(-75, -20)		30,313	-67	(-105, -28)	
Within centers[f]	30,313	-10	(-24, 5)		30,313	-7	(-21, 8)	
Cu								
Overall[d]	31,173	10	(-8, 27)	0.10	31,173	8	(-4, 19)	0.15
Between centers[e]	31,173	-54	(-132, 23)		31,173	-53	(-138, 31)	
Within centers[f]	31,173	12	(-5, 30)		31,173	8	(-3, 20)	
Fe								
Overall[d]	30,576	6	(-5, 16)	0.94	31,173	14	(1, 28)	0.37
Between centers[e]	30,576	9	(-83, 101)		31,173	-28	(-120, 65)	
Within centers[f]	30,576	6	(-5, 16)		31,173	15	(2, 29)	
K								
Overall[d]	30,382	11	(-11, 33)	0.20	30,576	14	(2, 27)	0.92
Between centers[e]	30,382	-19	(-68, 31)		30,576	12	(-42, 66)	
Within centers[f]	30,382	18	(-7, 42)		30,576	15	(2, 27)	
Ni								
Overall[d]	27,339	4	(-15, 22)	0.02	31,173	1	(-22, 24)	0.02
Between centers[e]	27,339	-47	(-89, -4)		31,173	-81	(-154, -8)	
Within centers[f]	27,339	10	(-10, 30)		31,173	7	(-17, 31)	
S								
Overall[d]	30,576	-40	(-64, -16)	0.03	30,576	-2	(-21, 17)	<0.01
Between centers[e]	30,576	-65	(-94, -35)		30,576	-52	(-80, -23)	
Within centers[f]	30,576	-13	(-48, 23)		30,576	12	(-10, 34)	
Si								
Overall[d]	31,173	26	(5, 48)	0.78	31,173	13	(-1, 27)	0.18
Between centers[e]	31,173	37	(-40, 114)		31,173	54	(-7, 114)	
Within centers[f]	31,173	26	(4, 47)		31,173	11	(-3, 25)	
V								
Overall[d]	31,173	5	(-13, 23)	0.04	31,173	13	(-8, 35)	0.60
Between centers[e]	31,173	-65	(-132, 1)		31,173	-12	(-107, 84)	
Within centers[f]	31,173	9	(-10, 27)		31,173	15	(-7, 37)	
Zn								
Overall[d]	30,576	-4	(-21, 12)	0.01	31,173	8	(-6, 21)	<0.01
Between centers[e]	30,576	-68	(-118, -18)		31,173	-77	(-140, -13)	
Within centers[f]	30,576	1	(-17, 18)		31,173	10	(-3, 23)	

[a]N refers to the number of subjects in each model. [b]Coefficient and 95% confidence interval (CI) change in birth weight (g) among term births (≥37 weeks of gestation) from pooled analyses using linear regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception per increments of 5 μg/m^3 for $PM_{2.5}$; 5 ng/m_3 for Cu $PM_{2.5}$; 100 ng/m^3 for Fe $PM_{2.5}$; 50 ng/m^3 for K $PM_{2.5}$; 1 ng/m^3 for Ni $PM_{2.5}$; 200 ng/m^3 for S $PM_{2.5}$; 100 ng/m^3 for Si $PM_{2.5}$; 2 ng/m^3 for V $PM_{2.5}$; 10 ng/m^3 for Zn $PM_{2.5}$; 10 μg/m^3 for PM_{10}; 5 ng/m_3 for Cu $PM_{2.5}$; 10 μg/m^3 for PM_{10}; 20 ng/m^3 for Cu PM_{10}; 500 ng/m^3 for Fe PM_{10}; 100 ng/m^3 for K PM_{10}; 2 ng/m^3 for Ni PM_{10}; 200 ng/m^3 for S PM_{10}; 500 ng/m^3 for Si PM_{10}; 3 ng/m^3 for V PM_{10}; and 20 ng/m^3 for Zn PM_{10}. [c]P-value from a test comparing the effect estimate of between center and within center. [d]Results correspond to the to the individual exposure estimates as reported in the main text and tables. [e]Results correspond to the centerwide mean. [f]Results correspond to the difference between individual exposure and centerwide mean exposure.

Table S11. Sex-stratified associations between exposure to PM constituents, birth weight and head circumference.

	Birth weight (g)						Birth head circumference (cm)					
		$PM_{2.5}$			PM_{10}			$PM_{2.5}$			PM_{10}	
Mass	N[a]	β[b]	(95%CI)	N[a]	β[b]	(95%CI)	N[a]	β[c]	(95%CI)	N[a]	β[c]	(95%CI)
Boys	15,354	-19	(-36, -2)	15,354	-16	(-35, 2)	10,694	-0.20	(-0.27, -0.13)	10,359	-0.20	(-0.27, -0.13)
Girls	14,959	-22	(-40, -5)	14,959	-15	(-34, 4)	10,694	-0.22	(-0.29, -0.15)	10,359	-0.21	(-0.28, -0.14)
Cu												
Boys	15,805	26	(2, 50)	15,805	16	(1, 32)	11,152	-0.27	(-0.36, -0.18)	10,771	-0.30	(-0.38, -0.21)
Girls	15,368	-12	(-36, 12)	15,368	-3	(-19, 12)	11,152	-0.16	(-0.22, -0.10)	10,771	-0.15	(-0.21, -0.09)
Fe												
Boys	15,500	13	(-2, 28)	15,805	14	(-5, 33)	11,152	-0.18	(-0.24, -0.13)	10,771	-0.19	(-0.24, -0.14)
Girls	15,076	-1	(-16, 13)	15,076	14	(-4, 33)	11,152	-0.19	(-0.26, -0.11)	10,771	-0.16	(-0.23, -0.09)
K												
Boys	15,409	3	(-25, 31)	15,500	9	(-8, 26)	11,152	0.28	(0.17, 0.39)	10,771	0.22	(0.11, 0.33)
Girls	14,973	12	(-18, 42)	15,973	21	(4, 38)	11,152	0.07	(0.01, 0.13)	10,771	0.01	(-0.05, 0.07)
Ni												
Boys	13,847	10	(-16, 36)	15,805	6	(-26, 38)	9,456	-0.48	(-0.62, -0.34)	9,148	-0.63	(-0.78, -0.48)
Girls	13,492	-13	(-37, 12)	15,368	-16	(-47, 16)	11,152	-0.43	(-0.56, -0.30)	10,771	-0.43	(-0.55, -0.31)
S												
Boys	15,500	-40	(-67, -14)	15,500	-1	(-25, 24)	11,152	-0.59	(-0.75, -0.43)	10,771	-0.79	(-0.97, -0.62)
Girls	15,076	-62	(-89, -35)	15,076	-28	(-51, -5)	11,152	-0.44	(-0.57, -0.32)	10,771	-0.56	(-0.69, -0.43)
Si												
Boys	15,805	27	(-1, 55)	15,805	9	(-10, 28)	11,152	-0.10	(-0.20, 0.01)	10,771	-0.15	(-0.26, -0.05)
Girls	15,368	29	(-1, 58)	15,368	22	(3, 42)	11,152	-0.07	(-0.14, -0.01)	10,771	-0.09	(-0.16, -0.02)
V												
Boys	15,805	8	(-17, 33)	15,805	20	(-10, 50)	11,152	-0.47	(-0.61, -0.32)	10,771	-0.38	(-0.51, -0.24)
Girls	15,368	-7	(-31, 18)	15,368	4	(-26, 33)	11,152	-0.44	(-0.59, -0.28)	10,771	-0.41	(-0.56, -0.27)
Zn												
Boys	15,500	-4	(-26, 19)	15,805	9	(-9, 28)	11,152	-0.15	(-0.25, -0.04)	10,771	-0.17	(-0.27, -0.07)
Girls	15,076	-14	(-37, 9)	15,368	2	(-16, 20)	11,152	-0.24	(-0.35, -0.14)	10,771	-0.28	(-0.38, -0.18)

[a]Coefficient and 95% confidence interval (CI) from pooled analyses using linear regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception per increments of 5 $\mu g/m^3$ for $PM_{2.5}$; 5 ng/m_3 for Cu $PM_{2.5}$; 100 ng/m^3 for Fe $PM_{2.5}$; 50 ng/m^3 for K $PM_{2.5}$; 1 ng/m^3 for Ni $PM_{2.5}$; 200 ng/m^3 for S $PM_{2.5}$; 100 ng/m^3 for Si $PM_{2.5}$; 2 ng/m^3 for V $PM_{2.5}$; 10 ng/m^3 for Zn $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 5 ng/m_3 for Cu $PM_{2.5}$; 10 $\mu g/m^3$ for PM_{10}; 20 ng/m^3 for Cu PM_{10}; 500 ng/m^3 for Fe PM_{10}; 100 ng/m^3 for K PM_{10}; 2 ng/m^3 for Ni PM_{10}; 200 ng/m^3 for S PM_{10}; 500 ng/m^3 for Si PM_{10}; 3 ng/m^3 for V PM_{10}; and 20 ng/m^3 for Zn PM_{10}. [b]Change in birth weight (g) among term births (≥37 weeks of gestation). [c]Change in birth head circumference (cm).

Table S12. Associations between exposure to PM constituents and birth head circumference results from the study population with information on atmospheric pressure and temperature and pressure adjusted models.

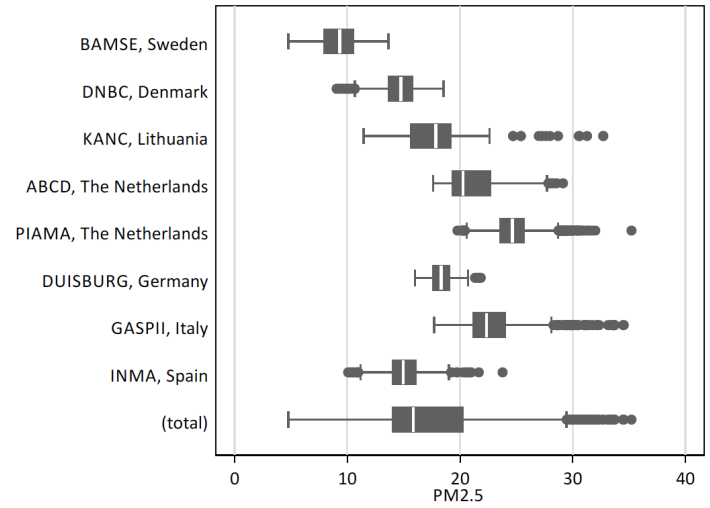
	Without adjustment for atmospheric pressure[a]						With adjustment for atmospheric pressure and temperature[b]					
	$PM_{2.5}$			PM_{10}			$PM_{2.5}$			PM_{10}		
Exposure	N	β	(95%CIs)	N	β	(95%CIs)	N	β	(95%CIs)	N	β	(95%CIs)
Mass	21,053	-0.23	(-0.29, -0.18)	21,053	-0.23	(-0.28, -0.17)	21,053	-0.25	(-0.31, -0.19)	21,053	-0.24	(-0.29, -0.19)
Cu	21,346	-0.30	(-0.36, -0.23)	21,346	-0.16	(-0.20, -0.12)	21,346	-0.30	(-0.36, -0.24)	21,346	-0.16	(-0.21, -0.12)
Fe	21,346	-0.19	(-0.23, -0.15)	21,346	-0.18	(-0.23, -0.13)	21,346	-0.20	(-0.23, -0.16)	21,346	-0.18	(-0.23, -0.13)
K	21,346	0.31	(0.22, 0.40)	21,346	0.04	(-0.004, 0.09)	21,346	0.31	(0.22, 0.40)	21,346	0.03	(-0.01, 0.08)
Ni	18,604	-0.60	(-0.71, -0.49)	18,604	-0.45	(-0.55, -0.34)	18,604	-0.59	(-0.70, -0.48)	18,604	-0.43	(-0.54, -0.33)
S	21,346	-0.80	(-0.93, -0.66)	21,346	-0.57	(-0.66, -0.47)	21,346	-0.78	(-0.91, -0.65)	21,346	-0.55	(-0.64, -0.45)
Si	21,346	-0.17	(-0.26, -0.09)	21,346	-0.11	(-0.17, -0.06)	21,346	-0.17	(-0.25, -0.09)	21,346	-0.11	(-0.16, -0.06)
V	21,346	-0.45	(-0.56, -0.35)	21,346	-0.48	(-0.59, -0.38)	21,346	-0.46	(-0.56, -0.35)	21,346	-0.49	(-0.60, -0.38)
Zn	21,346	-0.13	(-0.21, -0.05)	21,346	-0.26	(-34, -0.19)	21,346	-0.13	(-0.21, -0.05)	21,346	-0.25	(-0.33, -0.18)

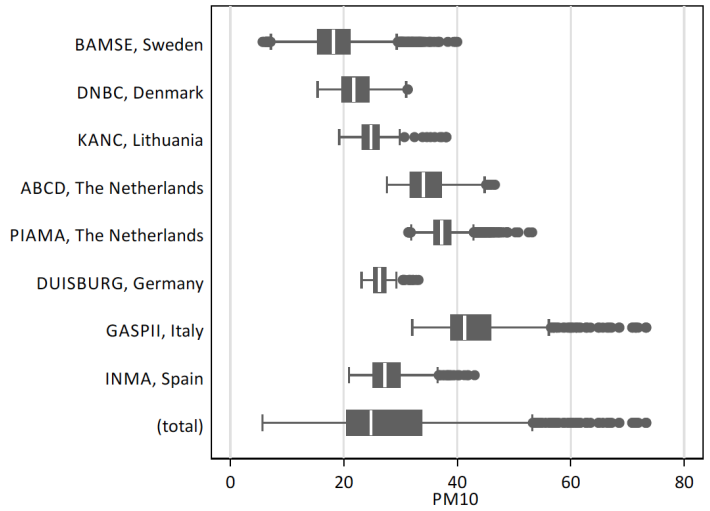
[a]Pooled analyses using regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception restricted to subjects with information on atmospheric pressure. [b]Further adjusted for atmospheric pressure during full pregnancy (mBar coded as restricted cubic spline) and temperature (°C coded as restricted cubic spline).

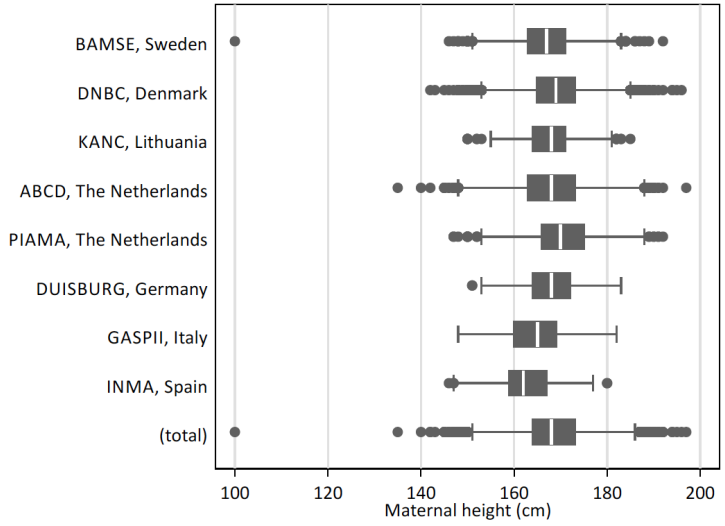
Table S13. PM constituents and birth head circumference results from between centers and within centers models.

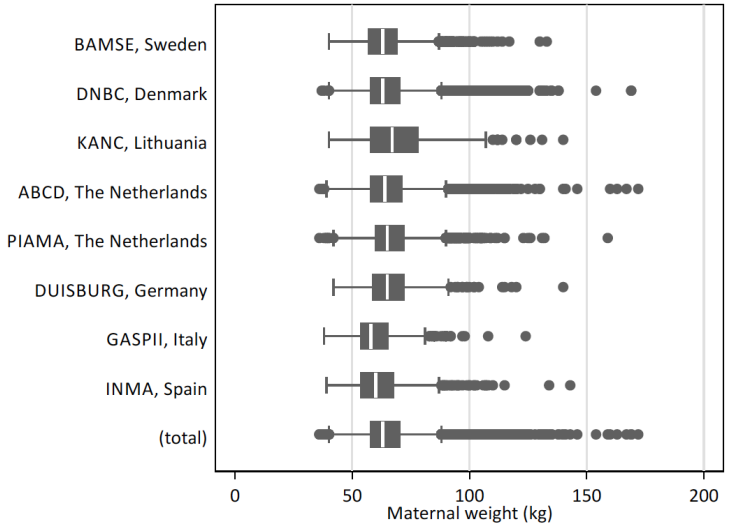
	$PM_{2.5}$				PM_{10}			
	N[a]	ß[b]	(95%CI)	p[c]	N[a]	ß[b]	(95%CI)	p[c]
Mass								
Overall[d]	21,053	-0.23	(-0.29, -0.18)	<0.01	21,053	-0.23	(-0.28, -0.17)	0.14
Between centers[e]	21,053	-0.09	(-0.18, 0.00)		21,053	-0.14	(-0.26, -0.03)	
Within centers[f]	21,053	-0.27	(-0.34, -0.21)		21,053	-0.25	(-0.31, -0.18)	
Cu								
Overall[d]	21,923	-0.29	(-0.36, -0.23)	0.22	21,923	-0.16	(-0.20, -0.11)	0.81
Between centers[e]	21,923	-0.17	(-0.37, 0.02)		21,923	-0.18	(-0.40, 0.04)	
Within centers[f]	21,923	-0.30	(-0.37, -0.24)		21,923	-0.15	(-0.20, -0.11)	
Fe								
Overall[d]	21,923	-0.19	(-0.22, -0.15)	0.49	21,923	-0.17	(-0.22, -0.12)	0.95
Between centers[e]	21,923	-0.10	(-0.35, 0.14)		21,923	-0.17	(-0.41, 0.08)	
Within centers[f]	21,923	-0.19	(-0.23, -0.15)		21,923	-0.17	(-0.23, -0.12)	
K								
Overall[d]	21,923	0.30	(0.22, 0.39)	<0.01	21,923	0.05	(0.00, 0.09)	0.19
Between centers[e]	21,923	-0.06	(-0.18, 0.06)		21,923	-0.04	(-0.18, 0.10)	
Within centers[f]	21,923	0.35	(0.26, 0.44)		21,923	0.05	(0.01, 0.10)	
Ni								
Overall[d]	18,604	-0.60	(-0.71, -0.49)	<0.01	21,923	-0.43	(-0.53, -0.33)	0.85
Between centers[e]	18,604	-0.23	(-0.43, -0.03)		21,923	-0.41	(-0.61, -0.22)	
Within centers[f]	18,604	-0.64	(-0.75, -0.52)		21,923	-0.43	(-0.55, -0.32)	
S								
Overall[d]	21,923	-0.79	(-0.93, -0.66)	<0.01	21,923	-0.57	(-0.66, -0.47)	<0.01
Between centers[e]	21,923	-0.17	(-0.28, -0.06)		21,923	-0.13	(-0.23, -0.02)	
Within centers[f]	21,923	-0.87	(-1.01, -0.73)		21,923	-0.62	(-0.72, -0.52)	
Si								
Overall[d]	21,923	-0.13	(-0.21, -0.05)	0.59	21,923	-0.09	(-0.14, -0.04)	0.29
Between centers[e]	21,923	-0.08	(-0.29, 0.14)		21,923	0.01	(-0.17, 0.19)	
Within centers[f]	21,923	-0.14	(-0.22, -0.06)		21,923	-0.10	(-0.15, -0.04)	
V								
Overall[d]	21,923	-0.45	(-0.56, -0.35)	0.02	21,923	-0.46	(-0.57, -0.35)	<0.01
Between centers[e]	21,923	-0.15	(-0.40, 0.10)		21,923	0.02	(-0.29, 0.34)	
Within centers[f]	21,923	-0.49	(-0.60, -0.38)		21,923	-0.49	(-0.60, -0.38)	
Zn								
Overall[d]	21,923	-0.13	(-0.21, -0.05)	<0.01	21,923	-0.25	(-0.33, -0.18)	0.06
Between centers[e]	21,923	-0.31	(-0.45, -0.17)		21,923	-0.42	(-0.60, -0.24)	
Within centers[f]	21,923	-0.09	(-0.18, 0.00)		21,923	-0.23	(-0.31, -0.15)	

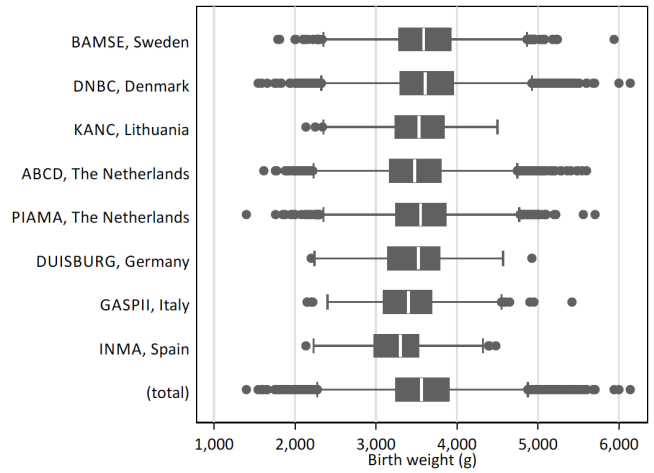
[a]N refers to the number of subjects in each model. [b]Coefficient and 95% confidence interval (CI) for change in mean birth head circumference (cm) from pooled analyses using linear regression models with random effect of centre adjusted for gestational age, sex, parity, maternal height, pre-pregnancy weight, maternal active smoking during 2nd trimester, maternal age, maternal education and season of conception per increments of 5 μg/m^3 for $PM_{2.5}$; 5 ng/m_3 for Cu $PM_{2.5}$; 100 ng/m^3 for Fe $PM_{2.5}$; 50 ng/m^3 for K $PM_{2.5}$; 1 ng/m^3 for Ni $PM_{2.5}$; 200 ng/m^3 for S $PM_{2.5}$; 100 ng/m^3 for Si $PM_{2.5}$; 2 ng/m^3 for V $PM_{2.5}$; 10 ng/m^3 for Zn $PM_{2.5}$; 10 μg/m^3 for PM_{10}; 5 ng/m_3 for Cu $PM_{2.5}$; 10 μg/m^3 for PM_{10}; 20 ng/m^3 for Cu PM_{10}; 500 ng/m^3 for Fe PM_{10}; 100 ng/m^3 for K PM_{10}; 2 ng/m^3 for Ni PM_{10}; 200 ng/m^3 for S PM_{10}; 500 ng/m^3 for Si PM_{10}; 3 ng/m^3 for V PM_{10}; and 20 ng/m^3 for Zn PM_{10}. [c]P-value from a test comparing the effect estimate of between center and within center. [d]Results correspond to the to the individual exposure estimates as reported in the main text and tables. [e]Results correspond to the centerwide mean. [f]Results correspond to the difference between individual exposure and centerwide mean exposure.

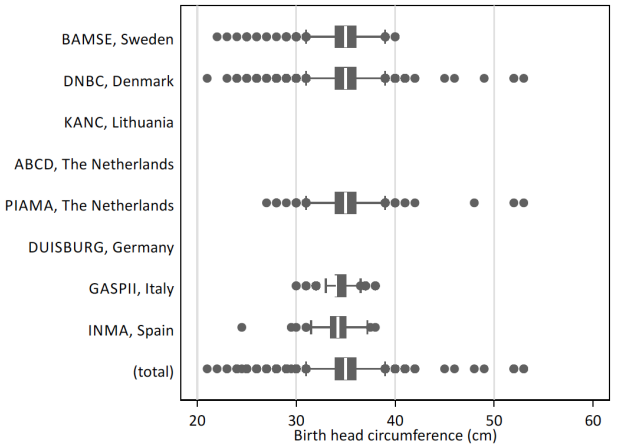

BAMSE, Sweden
DNBC, Denmark
KANC, Lithuania
ABCD, The Netherlands
PIAMA, The Netherlands
DUISBURG, Germany
GASPII, Italy
INMA, Spain
(total)
0
10
20
30
40
PM2.5


BAMSE, Sweden
DNBC, Denmark
KANC, Lithuania
ABCD, The Netherlands
PIAMA, The Netherlands
DUISBURG, Germany
GASPII, Italy
INMA, Spain
(total)
0
20
40
60
80
PM10


BAMSE, Sweden
DNBC, Denmark
KANC, Lithuania
ABCD, The Netherlands
PIAMA, The Netherlands
DUISBURG, Germany
GASPII, Italy
INMA, Spain
(total)
100
120
140
160
180
200
Maternal height (cm)


BAMSE, Sweden
DNBC, Denmark
KANC, Lithuania
ABCD, The Netherlands
PIAMA, The Netherlands
DUISBURG, Germany
GASPII, Italy
INMA, Spain
(total)
0
50
100
150
200
Maternal weight (kg)





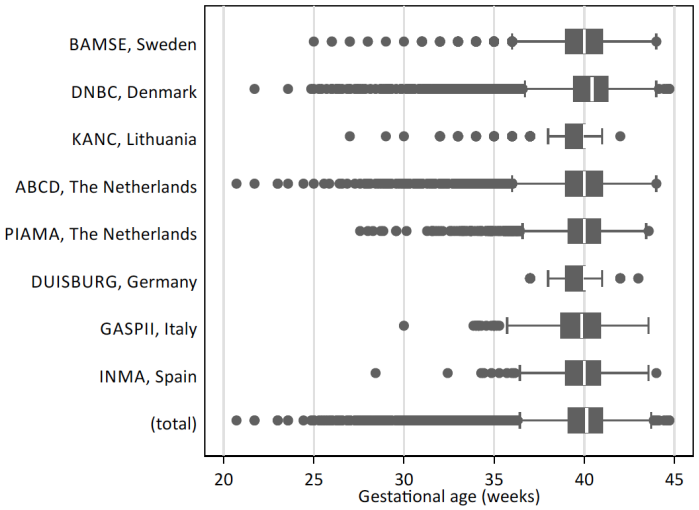


Figure S1. Distributions of $PM_{2.5}$, PM_{10}, maternal height, pre-pregnancy weight, birth weight, birth head circumference and gestational age by cohorts and for the pooled study population. The line in the middle of the box represents the median values, the ends of the box refer to the 25th and 75th percentiles and the ends of the whiskers indicate the variability outside the upper and lower quartiles (i.e., within 1.5 interquartile range of the lower quartile and upper quartile). Outliers are plotted as individual dots.